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RIR-6-76

Computer Based Education Around the World: Perspectives, Problems, & Prospects

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) AND USERS OF THE ERIC SYSTEM."

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ABSTRACT

The international development of computer-based education (CBE) is discussed in terms of its current status, problems, and future prospects. The present pattern of CBE activity reflects the global pattern of industrialization; however, many developing nations are interested or involved in CBE efforts. Four problem domains are discussed in the context of international CBE activity: technology, economics, politics, and instructional theory. The future prospects for CBE on an international scale are depicted via four scenarios: CBE as supplementary media, CBE as mainstream activity, CBE as a research methodology; and CBE as an educational dinosaur.

As the decade of the sixties unfolded, the use of computers to provide instruction, dispense guidance and counselling, administer examinations/tests, and manage individualized instruction , quickly progressed from the status of a novelty to an accepted educational methodology described most broadly as Computer Based Education (CBE). While the rapid pace of development has largely abated in the seventies, CBE activity continues to grow at a sustained rate. Thus in the 1970-76 period, the number of total programs available; the range of subject matter offered; the number of institutions involved; and the total number of hours of instruction, all increased steadily [6]. Many educators look to CBE as heralding a new age of educational theory and practice.

The impact of CBE activity can be measured on a global scale. However, even though CBE exists on a worldwide basis, CBE activity has tended to be parochial and confined within national boundaries. This article is an attempt to surmount such parochialism by examining some aspects of CBE in an international context. This includes an attempt to provide a perspective of the present international situation with respect to the development and implementation of CBE; consideration of problems inherent in CBE activity with emphasis on those of an international nature; and a sketch of some possible future scenarios which outline different prospects for CBE.

PERSPECTIVE

While CBE began as a predominantly North American activity (and perhaps still is at present), it has been rapidly dispersed throughout the world over the last decade. This section tries to provide a perspective on the current status of CBE activities in various countries. This is essentially a factual perspective based upon a particular data source; the published proceedings of the first and second IFIPS world conferences on computer education.

Figure 1 depicts the global distribution of speakers at the second international conference on computer education (1975).

Insert Figure 1 Here.

As can be seen from the map, the pattern of CBE activity reflects the general pattern of world industrialization. However, the Figure also reveals that there are two highly dense concentrations of CBE activity (i.e. central North America and northwestern Europe). These concentrations have important implications for the development of computer networks and resource sharing. Table 1 provides a finer-grained look at this distribution. The Table lists the number of speakers according to country for both the first international conference (1970 in Amsterdam;see [9]) and the second conference (1975 in Marseilles; see [7]).

Insert Table 1 here.

The Table shows that, in terms of the number of speakers, the U.S. and U.K. have dominated both conferences. The larger number of papers presented by France in 1975 relects a dramatic upswing in French interest in CBE as well as its position as host country. The number of papers presented by German speakers also increased considerably between 1970 and 1975. The relative prevalance of France, England, and Germany may reflect the effects of recent financial support of CBE activity by the federal government in these three countries.

Perhaps the most interesting aspect of this Table is the large number of socalled "developing" nations who were not represented at the first conference in 1970 (most of the countries listed in the second column of Table 1). This appears to be a clear indication of increased CBE activity in developing nations.

Table 2 provides a list of conference delegates (rather than speakers) for the 1975 conference. (This list was derived from the published list of participants.)

Insert Table 2 Here.

To a certain extent, the distribution simply reflects the relative proximity of countries to the conference site (i.e.

France), however, the total number of delegates provides a rough index of the level of interest (circa 1975) in CBE. Thus the largest number of delegates come from France obviously reflecting its position as the host country; however, the relatively large number of delegates from countries such as Sweden, Australia or Japan reflects a strong national interest in CBE. The distribution of Table 2 (delegates) can be constrasted with that of Table 1 (speakers) in that the list of speakers gauges the current level of CBE activity while the distribution of delegates taps the level of interest in a particular country. For example, in terms of developing countries, a large number appear to be at the stage of active involvement (those listed in Table 1) while many others are at a stage of interest or planning (those in Table 2).

The limitations of this data should be evident; it exists within the context of a particular organizational framework (IFIPS) and reflects a single aspect of CBE activity (namely conference attendence and presentation). The conference representation of countries (either as delegates or speakers) only skims the surface of actual CBE activity. Furthermore, this data does not reflect the nature or quality of CBE activity. For this, it is necessary to consult the actual papers given at these conferences or recent anthologies describing work in particular countries (e.g. [2], [4], [11]). Despite these limitations, an important perspective emerges from this data; CBE activity is widely dispersed among developed and developing countries

alike. The question arises as to whether CBE will serve to narrow or widen the gap between these two groups.

PROBLEMS

CBE activity is an amalgam of at least four major aspects: technology, economics, politics, and instructional theory. Each of these components (and their interaction) gives rise to a particular domain of problems which influence and shape all CBE research and use. This section discusses these problem domains in the context of the international perspective developed above. For detailed discussion of similar problems from within domestic persepctives, see [1], [8] , or [10] .

Figure 2 may be helpful in conceptualizing these problem domains and their interrelationships.

Insert Figure 2 Here

Beginning with the technological domain, the problems here center around the availability of suitable CBE resources (including hardware, software, and humanware). For those developing nations with no real industrial base, the simple procurement of the necessary resources (particulaly humanware) represents a major problem in CBE activity. Given these pre-requisite resources, there still exists the need for the specialized technology demanded by CBE activity. The technological problem for developed countries is at this

more sophisticated level -- it revolves around the availability of suitable CBE technology. This includes inexpensive CRT terminals, off-the-shelf author languages and performance recording systems, CPU and telecommunication systems which provide very fast and reliable response, etc. Thus, it is not merely a matter of possessing ample computer technology, but a technology suitable to CBE activities.

Many of these technological problems have what are essentially technical solutions (i.e. developments in hardware/software). However, it should be clear that many of the problems in the technological domain overlap with problems of an economic nature. Thus, the distribution of CBE activity (say as depicted in Figure 1) essentially represents the economic status of world nations. As international economic patterns change, we can reasonably expect the international development of CBE to correspondingly alter. For example, we might expect the middle eastern nations (with their suddenly acquired oil-wealth) to become interested in CBE activities. The point is simply that the wax or wane of CBE (and education more generally) is tied to the overall economic state of a nation. *

In terms of developed nations, specific economic

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* This statement is brought closer to home by the recent demise of the journal: International World of Computer Education , which had to cease publication because of economic shortages in the member countries supporting the journal.

problems abound. The large capital investment required for the development of CBE material is a major obstacle. The high cost of a suitable terminal (as compared to say a textbook), is a limiting factor in the widespead dispersion of CBE. In some cases, it is the prohibitive telecommunication costs which make CBE economically unfeasible. Despite rational and sound arguments on the long-term economic feasibility of CBE, most educators feel that chalk and talk is still cheaper than bits and bytes.

Many of these economic problems have solutions which are tied to technological problems (e.g. cheaper terminals). Many, however, involve the political domain. Problems such as funding of CBE activity and cost/benefit demands are fundamentally political in nature in that they are issues dealing with the distribution of power or control within an educational system.

At the international level, CBE activity represents an advanced educational status whose possession can be stategically valuable or threatening (analogous to nuclear weaponry). At the intra-national level are the problems of CBE funding--federal or local. The issue here is what level of government is to control CBE activity and hence specify educational goals and objectives. At the level of local implementation, there are further political problems. For example, within a university context, there exists the problem of whether CBE activity is the responsiblity of educational specialists or specialists in the subject matter

domain. The question of whether CBE activities count as legitimate teaching duties has been raised on many occasions. Furthermore, the balance of power within an educational system shifts from educators and academics to computer managers and specialists; in the classroom, the teacher's traditional role is threatened. *

This last point brings us to the fourth problem domain -- instructional theory. Included in this domain are problems and issues which arise out of the conceptual foundations of instruction and teaching; problems such as individualization, instructional design and objectives, basic learning styles, evaluation and measurement of learning, etc. The problems in this domain involve what is to be taught and how.

Most nations differ in their cultural-social-ideological values and hence their overall educational goals and objectives. In terms of needs, developing countries may have particular requirements for computer specialists as well as a more basic need to raise the level of literacy in the general population. Because of these needs, certain subject matters and instructional strategies are most appropriate. Furthermore, the instruction must be adapted to the particular cultural/ social features of that nation. This means that differences are to be expected in the instructional theory developed by different nations. The

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* For a valuable in-depth study of the internal politics of CBE activity, see [5].

transfer of programs may not be as simple a matter as technical and economic feasibility. The point I'm trying to get at is brought out clearly in [3] reporting their attempts to introduce Canadian native students to CBE. They remark:

> A demonstration of a computer terminal to a native group is liable to emphasize superficial properties which are heavily loaded with cultural overtones foreign to native spirit. Thus the true nature of informatics is occluded by the colour, shape, and alphabetic symbols of the keyboard or the mechanical behavior and sound of the print chain...The difficulties encountered in the use of a standard terminal are an indicator of the much more serious impasse in the interactions between cultures. The failure of our initial demonstrations led us to realize that the terminal was only one aspect of a high cultural barrier. This might be expressed in the statement that instead of the elements of informatics the native person encounters the operational mode of Western science and the symbols of the phonetic alphabet. (p. 387)

The international usage of CBE has the potential to raise serious cultural and ideological clashes if not deployed carefully. Thus it is necessary to base CBE upon instructional theory which is culturally and ideologically appropriate to the nation in which it is to be used. This is simply an extension of the basic importance of ensuring that

CBE design is geared to the group or population it will be used with.

We come the full circle of problem domains when we consider the intersection of the problem domains of instructional theory and technology. This involves the constraints which existing technology (hardware or software) place on instructional strategies and methods. Clearly, those nations with advanced CBE systems have the potential to employ more sophisticated (and presumably effective) instructional methods. This relationship works the other way around too--the development of instructional theory allows the possibility of technological implementation. An example here is individualized instruction; we still lack a solid and systematic theoretical basis for adapting instructional parameters to individual parameters, and hence lack the necessary conceptualization upon which to develop adequate individualized software.

The preceding discussion has outlined four major problem domains in CBE activity. While the threads of many of the arguments have been left dangling, the general nature of the problems in the context of international activity should be clear.

PROSPECTS

As the reader will undoubtedly realize, "solutions" to the problems outlined above come in the form of alternative choices or courses of action--all of which entail compromise at some level. Rather than outline these alternatives on a one-one basis, I will simply elucidate four scenarios which could depict CBE activity in the future. Each of these scenarios embodies a selection of alternatives in the problem domains discussed. I will leave it to the reader to make the exact connections.

Scenario A: CBE as an enrichment medium.

In this perspective, CBE is a single component of educational materials and is utilized mainly in an enrichment capacity in the same way as audiovisual materials are used presently in the classroom. There is a need for specialists who maintain and develop CBE materials.

Scenario B: CBE as mainstream education.

Here CBE becomes the major mode of instruction; it encompasses and supplants the teacher, textbooks, tests/examinations, counselling and guidance. CBE design and evaluation becomes an integral part of the educational system; teachers become instructional technologists.

Scenario C: CBE as a research tool

CBE is utilized as a sophisticated educational research device for the evaluation of instructional methods, testing & diagnostic procedures, types of

instructional design, and techniques of individualized instruction. CBE is taught as a research methodology not as an instructional methodology.

Scenario D: CBE as an educational dinosaur.

CBE activity and research fades from the educational scene possibly taken over by commercial interests (as radio and TV) or becomes obsolete due to a newer technology.

The first three of these scenarios already exist to varying degrees in different countries. It is likely that each of these alternatives may eventually characterize CBE activity in different countries or within the same country for different student populations at different stages. The last scenario could also be an eventuality--depending upon the selection or non-selection of the other three scenarios.

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Figure 1. Global Distribution of Speakers at the 2nd World Conference on Computer Education.

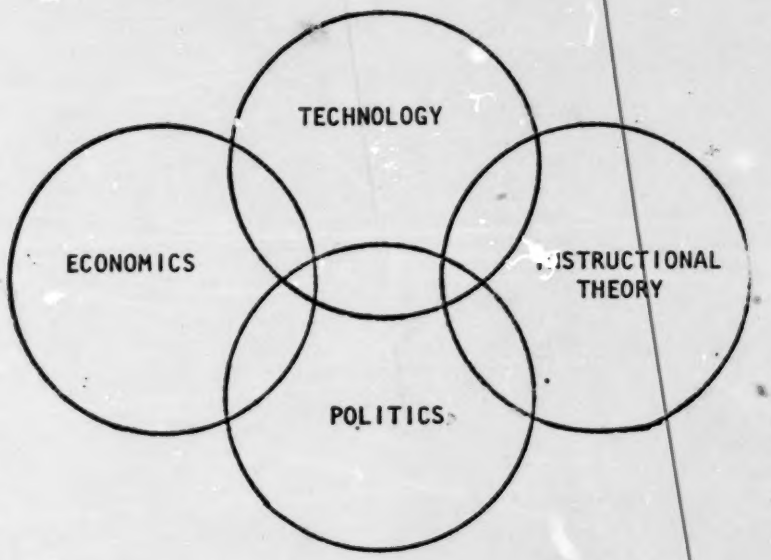

Figure 2. Major Problem Domains in CBE Activity.

TABLE 1

Number of speakers by country at the 1st and 2nd IFIPS world conference on computer education.

COUNTRY	1970	1975	COUNTRY	1970	1975
U.S.A	67	69	Spain	-	3
France	10	55	Mexico	-	3
U.K.	51	45	Switzerland	-	3
Germany	4	17	Belgium	-	3
Canada	14	8	Poland	-	2
Japan	5	6	India	-	2
Brazil	4	6	Algeria	-	2
Sweden	1	6	South Africa	-	2
Netherlands	9	5	Phillipines	-	1
Hungary	2	4	Paraquay	-	1
Australia	4	3	Bulgaria	-	1
Denmark	3	3	Rumania	-	1
Italy	6	3	Argentina	-	1
Israel	2	3	Thialand	-	1
U.S.S.R.	3	2	Yugoslavia	-	1
Czechslovakia	5	1	Malaysia	-	1
Austria	3	1	Peru	-	1
Finland	3	-	Kenya	-	1
New Zealand	1	-	Nigeria	-	1
Chile	1	-			
Ghana	1	-			

TABLE 2

Number of delegates by country at the second IFIPS world conference on computer education.

COUNTRY	1975	COUNTRY	1975
France	208	Ireland	4
Great Britain	97	Israel	3
West Germany	65	South Africa	3
U.S.A.	55	Cuba	3
Netherlands	48	Mexico	3
Sweden	35	Austria	2
Hungary	29	Cameroons	2
Switzerland	26	Iran	2
Denmark	24	Kenya	2
Japan	21	Malaysia	2
Canada	20	Argentina	1
Italy	19	Chile	1
Belgium	19	Costa Rica	1
Australia	17	Egypt	1
Czechslovakia	16	Greece	1
Spain	13	India	1
Rumania	12	Portugal	1
Brazil	11	Morocco	1
Poland	10	Thialand	1
Yugoslavia	6	Tunsia	1
Finland	5	Uruquay	1
Algeria	4	U.S.S.R	1
Iraq	4	Nigeria	1
		Peru	1